MORRIS & RITCHIE ASSOCIATES, INC.

ARCHITECTS, ENGINEERS, PLANNERS, SURVEYORS,
AND LANDSCAPE ARCHITECTS

March 12, 2007

Mr. Sam Frampton
Verizon Wireless
9000 Junction Drive
Annapolis Junction, MD 20701

Re: Round Hill Site
Water Tank Analysis
Louden County, Virginia
MRA Job No. 10427.276

Dear Sam:

As requested by Verizon Wireless, Morris & Ritchie Associates, Inc. (MRA) has completed a structural analysis of the 145.00' pedisphere water tower located on Evening Star Drive in Round Hill, Virginia. The objective of MRA's analysis was to determine if the existing water tower can structurally support the desired antenna configuration proposed by Verizon Wireless and three (3) future carriers and meet the requirements of the 2003 International Building Code (IBC 2003) and the AISC Manual of Steel Construction, Load Resistance Factor Design (LRFD).

The structural analysis has been based upon existing structural drawings of the tank, as well as field measurements and survey to verify the height of the tower. Although the structural drawings of the tank show a 142'-0" overall tank height, the field survey reflected a 145'-0" tank. The 145'-0" height was used in the analysis because it is slightly more conservative.

The existing water tank is a pedisphere-type structure with the following dimensions:

- Height of bell = 31'-0"
- Height of riser shaft = 73'-6"
- Height of bowl = 39'-6"
- Diameter of bell = 31'-0" (bottom) 12'-0" (top)
- Diameter of central riser = 12'-0"
- Diameter of bowl = 55'-6"

This analysis examines the impact of installing six (6) Antel LPA80080/8CF and six (6) Antel LPA185080/8CF panel antennas to transmit and receive Verizon Wireless telecommunication, at elevation 151'-7". These twelve (12) antennas will be installed on a pod mount which is to be attached to the existing access tube at the top of the tank. Antennas for three additional carriers were also taken into account for this analysis.

As per IBC 2003, our analysis evaluated the tower under the following conditions:

IBC 2003 - 90 mph Wind Force + No Ice (3 second gust)
IBC 2003 - 90 mph Wind Force + ½" Ice (3 second gust)
(w/ 25% reduction wind load = 78 mph wind speed)
(Wind direction factors +/-Normal, 60 and 90 degrees to face of the structure)

In order to complete the analysis, MRA made the following assumptions, all assumptions are conservative to obtain the maximum wind area on the tank:

- The cross sectional area of the water tank is normal to the wind force. This assumption does not take into account that the water tank is rounded, but that it is flat.
- The bowl of the tank is a perfect ellipse.
- The future carriers will install four (4) 8'-0" high x 0'-6" wide antennas per sector.
- One (1) additional pod mount assembly will be added to the top of the tank (8' extension to proposed assembly).

Our structural analysis indicates that, under the conditions noted above the addition of Verizon Wireless's antennas, pod mount, and three (3) additional carriers' antennas will not increase the existing water tank beyond its structural capacity. The addition of Verizon Wireless's antennas, pod mount, and future carriers' appurtenances will increase the overturning moment on the water tank by a total of 2.0%. We have included a copy of our structural calculations for your review and use.

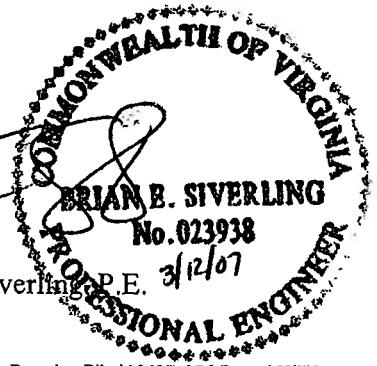
Although the existing tank can structurally accommodate the proposed installation of up to three (3) additional carriers, there will be several logistical problems with installing this many carriers:

- One (1) of the carriers will have to mount directly to the top of the tank. In order to install antennas directly to the tank, mounts will need to be welded directly to the tank which in turn could cause damage to the interior coating of the tank as well as the exterior coating. Also, the tank will need to be emptied while any welding is in progress to insure that the water in the tank is not contaminated by the welding and any necessary repairs to the tank can be completed.
- Because of OSHA regulations for minimum clearness for access, the coaxial cable cannot be stacked in the access tube. With Verizon Wireless' coaxial cable being run through the access tube, it will be possible to run one (1) additional carrier's coaxial cable through the access tube. The coaxial cable for additional carriers must be run on the outside of the tank, but that will also require welding to the tank. See attached 'Sketch 1'.

- In order for a future carrier to run coaxial cables up the access tank, additional penetrations must be made at the base of the tank, and at each platform. Verizon Wireless is showing their coaxial cable coming through the top of the doorway.
- Four (4) carriers, and two (2) sets of coax running up the exterior of the tank will increase the visual impact of the tank. See attached tank elevation.

We appreciate the opportunity to be of service on this project. If you should have any questions or require any additional information, please do not hesitate to call our office.

Sincerely,
MORRIS & RITCHIE ASSOCIATES, INC.

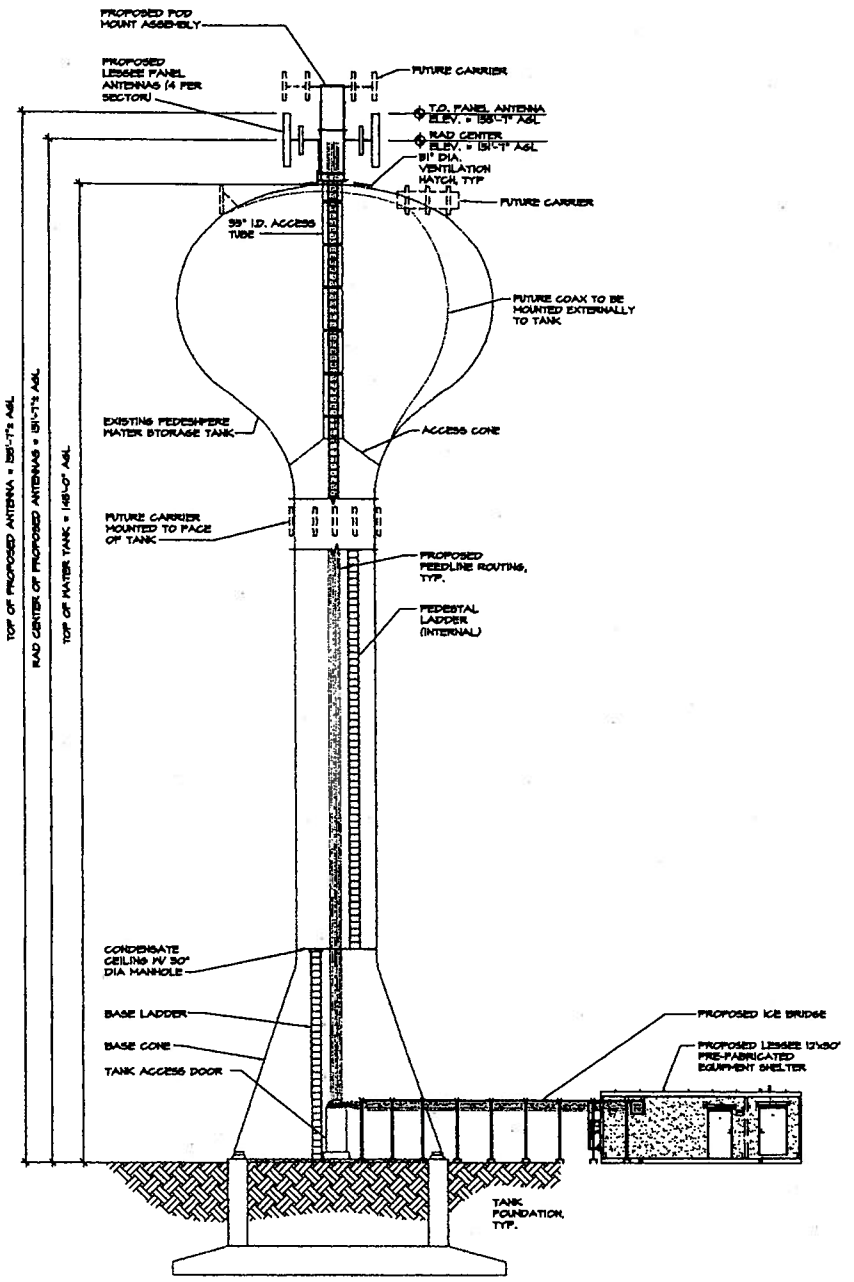


Emily Olivetti
Project Engineer

Brian E. Siverling, P.E.
Principal

JGB:V:\bg_PROJECTS\ 09000-10999\10427 Verizon Wireless Projects\10427 Verizon Wireless Drawing Files\10427_276 Round Hill\Letter

EXHIBIT A-3



WATER TANK ELEVATION

SCALE: NTS

MRA

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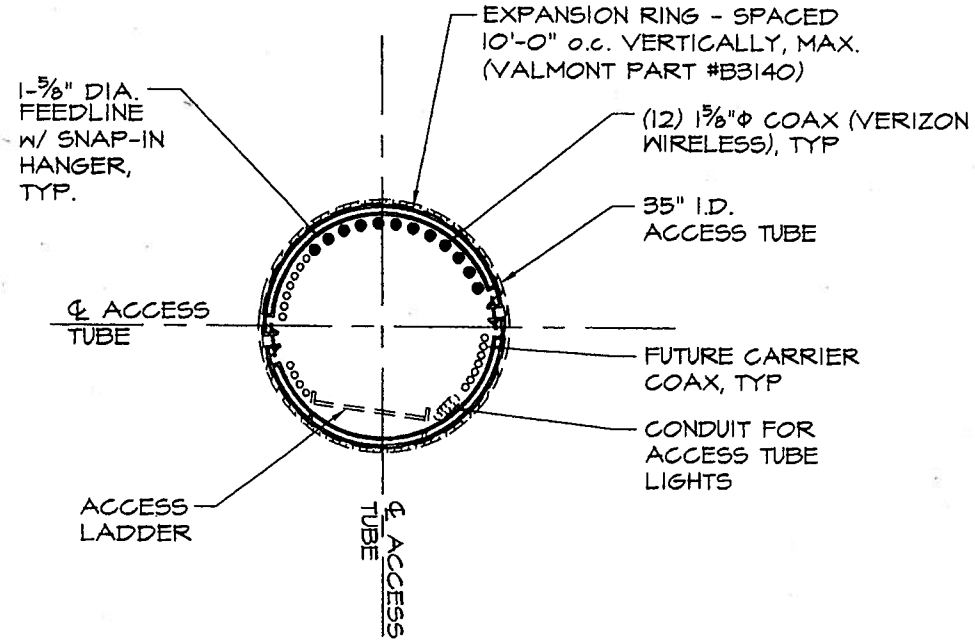
ROUND HILL WT

EVENING STAR DRIVE
ROUND HILL, VIRGINIA

SCALE:	DATE:	DRAWN BY:	DESIGN BY:	REVIEW BY:	JOB NO.:
AS NOTED	3/5/07	EEO	EEO	BES	10427.276



COAX SUPPORT AT ACCESS TUBE

SKETCH 1

SCALE: ½" = 1'-0"

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MORRIS & RITCHIE ASSOCIATES, INC. ENGINEERS, PLANNERS, SURVEYORS AND LANDSCAPE ARCHITECTS 1220-C East Joppa Road Suite 505 Towson, Maryland 21286 (410) 821-1690 Fax (410) 821-1748			**ROUND HILL WATER TANK** **EVENING STAR DRIVE** **ROUND HILL, VIRGINIA**		
SCALE: AS NOTED	DATE: 3/12/07	DRAWN BY: EEO	DESIGN BY: EEO	REVIEW BY: BES	JOB NO.: 10427.276

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- ☐ TOWSON, MD 410-821-1690 • 410-821-1748 (FAX)
- ☐ LAUREL, MD 410-792-9792 • 410-792-7395 (FAX)
- ☐ WILMINGTON, DE 302-326-2200 • 302-326-2399 (FAX)
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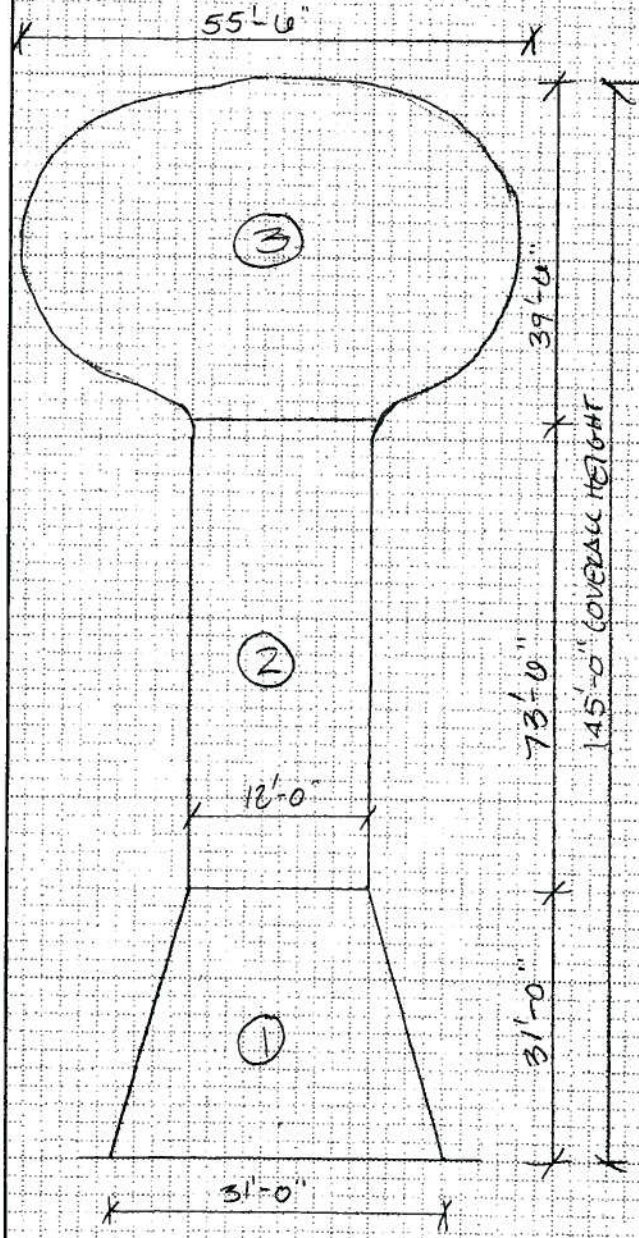
JOB 10427.276
SHEET NO. 1 OF
CALCULATED BY GEO DATE 3/9/07
CHECKED BY DATE
SCALE

ROUND HILL WATER TANK:



WIND AREA:

SECTION ①: $2\left[\frac{1}{2}(31')(9.5')\right] = 294.5\ SF$

$31'(12') = 372\ SF$

$\Sigma = 6666.5\ SF$

SECTION ②: $12'(73.5') = 882\ SF$

SECTION ③: $\pi(55.5')(39.5') = 6887\ SF$

TOTAL AREA = ① + ② + ③

$= 6666.5 + 882 + 6887$

$= 8435.5\ SF$

WIND LOAD (PER ASCE 7)

$F = q_z C_f A_f$

$q_z = 0.00256 K_z K_{zt} K_d V^2 I$

$q_z = 0.00256(1.30)(1.0)(0.95)(90^2)(1.15)$

CAT: C IMPORTANCE: IV

$q_z = 30.8$

$C_f = 0.628$

$A_f = 8435.5$

$F = 30.8(0.628)(8435.5)$

$F = 163,162\ lb$

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CENTROID OF WATER TANK:

Section	A	$\bar{y}$ from base	$A\bar{y}$
①	666.5	13.2	8797.8
②	882	67.75	59755.5
③	6887	124.25	855709

$\Sigma_A = 8435.5$ $\Sigma_{A\bar{y}} = 924263$

$\frac{\Sigma A\bar{y}}{\Sigma A} = \frac{924263}{8435.5} = 109'$ (FROM BASE)

OVERTURNING MOMENT OF TANK:

$M_{OT} = Fd = 163,162\#(109')$

$M_{OT} = 17784658\#\cdot ft = 17784\ k\cdot ft$

ADDITIONAL WIND AREA FROM ANTENNAS:

ANTENNA AREA:

VERIZON ANTENNA AREA: $2(7.875' * 0.458') = 7.2135\ ft^2$

$2(3.95' * 0.34') = 2.686\ ft^2$

$\Sigma = 9.8995\ ft^2$

(2) FUTURE CARRIER ANTENNAS + MOUNTS $8(6' * 0.5') = 24\ ft^2$

VERIZON WIRELESS PCD MOUNT: $3.5' * 7' = 24.5\ ft^2$

TOTAL AREA INCREASE = 58.4 SF

MOMENT INCREASE @ BASE:

$F = q_z C_f A_s = 30.8(1.45)(58.4)$
↳ TABLE

$F = 2608\#$

$M = Fd = 2608\#(148.5') = 387\ k\cdot ft$ (ADDITIONAL @ BASE)

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SHEET NO 3 OF
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SCALE

MOMENT INCREASE = $\frac{387^{k\cdot ft}}{17784^{k\cdot ft}} = 0.02 = 2\%$ INCREASE

ASSUMPTIONS:

1. BOWL IS AN ELLIPSE
2. CROSS SECTIONAL AREA IS NORMAL TO WIND FORCE (TANK IS FLAT, NOT ROUND)
3. FUTURE CARRIERS WILL INSTALL (4) 8' x 6" ANTENNAS PER SECTOR

WITH ALL ASSUMPTIONS BEING CONSERVATIVE & A 2% INCREASE IN OVERTURNING IS MINIMAL

TANK IS O.K. W/ VZW & FUTURE CARRIERS //